
Human embryonic stem cell derived islet progenitors mature inside an encapsulation device without evidence of increased biomass or cell escape.

Journal: Stem Cell Res

Publication Year: 2014

Authors: Kaitlyn Kirk, Ergeng Hao, Reyhaneh Lahmy, Pamela Itkin-Ansari

PubMed link: 24788136

Funding Grants: Masters of Science Specialization in Stem Cell Technology

Public Summary:

There are several challenges for using deriving a cell therapy from human embryonic stem cells (hESC) for treating insulin-dependent diabetes. Among these are development of functional insulin-producing cells, a delivery method that eliminates the need for suppressing the patient's immune system, and assurance that hESC-derived tumors do not form in the patient. We and others have shown that encapsulation of cells in an immune-isolation device protects cells in rodents and primates. Here we monitored human insulin secretion and measured the maturation, growth, and containment of precursors to insulin-producing cells derived from hESC, transplanted into mice. Human insulin was detectable by 7 weeks post-transplant and increased dramatically over the course of 8 weeks, yet during this period the number of encapsulated cells remained constant. Remarkably, by 20 weeks post-transplant encapsulated cells secreted sufficient levels of human insulin to treat diabetes. Further, hESCs-derived cells remained fully contained in the immune-isolation devices for up to 150 days, the longest period tested. Collectively, the data suggest that immune-isolated hESC-derived progenitors to insulin producing cells hold great promise as an effective and safe cell replacement therapy for insulin dependent diabetes.

Scientific Abstract:

There are several challenges to successful implementation of a cell therapy for insulin dependent diabetes derived from human embryonic stem cells (hESC). Among these are development of functional insulin producing cells, a clinical delivery method that eliminates the need for chronic immunosuppression, and assurance that hESC derived tumors do not form in the patient. We and others have shown that encapsulation of cells in a bilaminar device (TheraCyte) provides immunoprotection in rodents and primates. Here we monitored human insulin secretion and employed bioluminescent imaging (BLI) to evaluate the maturation, growth, and containment of encapsulated islet progenitors derived from CyT49 hESC, transplanted into mice. Human insulin was detectable by 7 weeks post-transplant and increased 17-fold over the course of 8 weeks, yet during this period the biomass of encapsulated cells remained constant. Remarkably, by 20 weeks post-transplant encapsulated cells secreted sufficient levels of human insulin to ameliorate alloxan induced diabetes. Further, bioluminescent imaging revealed for the first time that hESCs remained fully contained in encapsulation devices for up to 150 days, the longest period tested. Collectively, the data suggest that encapsulated hESC derived islet progenitors hold great promise as an effective and safe cell replacement therapy for insulin dependent diabetes.

Source URL: <http://www.cirm.ca.gov/about-cirm/publications/human-embryonic-stem-cell-derived-islet-progenitors-mature-inside>